PHYTOTOXICOLOGY SECTION
INVESTIGATION
IN THE VICINITY OF
SUNCOR LTD, SARNIA
ON SEPTEMBER 6, 1990

JANUARY 1992

Ontario
Environment
Environnement

ISBN 0-7729-9198-7

PHYTOTOXICOLOGY SECTION INVESTIGATION IN THE VICINITY OF SUNCOR LTD, SARNIA ON SEPTEMBER 6, 1990

Report prepared by:

Air Resources Branch
Ontario Ministry of the Environment

January 1992

Cette publication technique
n'est disponible qu'en anglais.

Copyright: Queen's Printer for Ontario, 1991
This publication may be reproduced for non-commercial purposes
with appropriate attribution.

PIBS 1771

Section 1: Background

The Alkylation Unit at the Suncor refinery in Sarnia produces a hydrocarbon waste product that contains organic and inorganic fluoride material. The burning of this waste product results in emissions of fluoride to the atmosphere. Stack sampling and subsequent modeling had indicated that the half hour point of impingement limit could be exceeded. Two Phytotoxicology assessment surveys, one each in 1986 and 1987, have been conducted in the vicinity of the refinery to determine if fluoride emissions from the Alkylation Unit were affecting vegetation (1,2). Marginally elevated levels of fluoride where found at some sites in both surveys. However, neither the amount of fluoride nor the pattern of accumulation agreed with the model. While the levels of fluoride in the modeling had suggested that there should be significant amounts of fluoride injury on local vegetation, no fluoride injury was ever observed on fluoride sensitive species.

The Phytotoxicology assessment survey was repeated in September of 1990 to confirm the results of the first two surveys. The following is the report on the results of the 1990 survey.

Section 2: Methods

On September 6, 1990 Randall D. Jones, of the Phytotoxicology Section, Air Resources Branch and Larry VanAsseldonk of the Sarnia District Office, Ministry of the Environment, conducted a Phytotoxicology assessment survey in the vicinity of the Suncor refinery in Sarnia. Duplicate samples of tree foliage from both silver maple and red ash were collected, where possible, at six of the eight stations sampled in the 1987 survey. The approximate locations of the sampling stations are given in the sketch map in Appendix A. The samples were collected using standard Phytotoxicology sampling techniques (3).

All samples for inorganic analysis were delivered to the Phytotoxicology Section sample processing laboratory in Toronto where they were dried and ground before being submitted to the Inorganic Trace Contaminants Section, Laboratory Services Branch, for inorganic chemical analysis. The samples were analyzed for fluoride.

Section 3: Results

No fluoride-type injury was observed on any of the sampled trees, or on any of the other fluoride-sensitive vegetation in the sampling area.

The results of the chemical analysis for fluoride in silver maple and red ash foliage are given in the following table. Also listed in the table is the Phytotoxicology Section Urban Upper Limit of Normal for fluoride in foliage (4). Levels exceeding the Upper Limits of Normal (ULN) have been indicated in bold type. The results are expressed as μg/g dry weight and are the mean of the duplicate samples collected at each site.

Results of the Fluoride Analysis of Silver Maple and Red Ash Foliage Collected in the Vicinity of Suncor Ltd., Sarnia on September 6, 1990

Station Number and Location	Sample Type	Fluoride in µg/g dry weight 1986	1987	1990
1 - 1.25 km, SE	Silver Maple	13	8	9
	Red Ash	NS	<4	5
3 - 3.5 km, SSW (Control)	Silver Maple	6	12	11
	Red Ash	NS	8	10
4 - 0.33 km, WSW	Silver Maple	**84**	22	**65**
5 - 1.38 km, ENE	Silver Maple	15	18	16
	Red Ash	NS	22	26
7 - 1.35 km, E	Silver Maple	NS	**NS**	NS
	Red Ash	NS	**44**	11
8 - 0.37 km, SSE	Red Ash	NS	33	24
Urban ULN*		35	35	35

"NS" not sampled in that year. * - see Appendix C

Section 4: Discussion

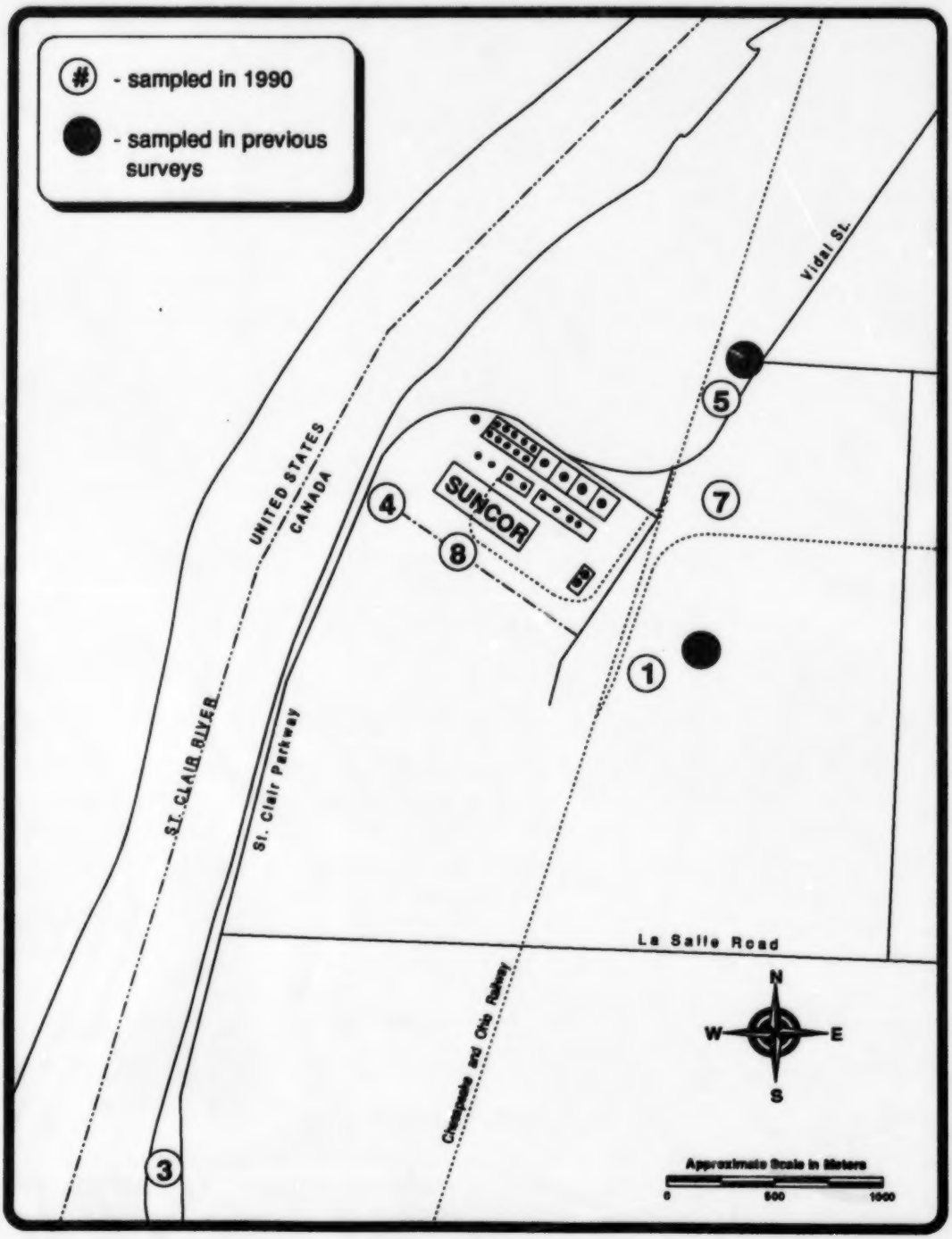
The results of the 1990 survey were consistent with the previous two surveys. The highest fluoride levels were immediately south of the Alkylation Unit at Station 4. This was the only site where the Urban Upper Limit of Normal for fluoride in vegetation was exceeded in 1990, although an exceedence also occured at Station 7 in 1987. The levels to the north of the unit, at Stations 5 and 7 were marginally elevated compared to the control station. The area to the north is where the modelling of the emissions indicated as the area of maximum impact. As in the previous surveys, the levels east of the plant were not significantly different from the control. None of the fluoride levels were high enough to result in injury, which confirmed the visual observation.

Section 5: Summary

While the Alkylation Unit at the Suncor refinery in Sarnia is a source of fluoride emissions, the results of the 1986, 1987 and 1990 Phytotoxicology Assessment surveys show that these emissions are having minimal impact on the local vegetation. The results suggest that the ground level concentrations are not as high as the modelling predicted, or that the number of exceedences of the half hour point of impingement standard are small, or the exceedences do not occur during the growing season.

Appendix A:

Sketch Map Showing the Approximate Location of the Six Sites Sampled for Tree Foliage in the Vicinity of Suncor Ltd., Sarnia on September 6, 1990



Appendix B: References

(1) Ontario Ministry of the Environment. 1986. A Report on a Phytotoxicology Section Investigation in the Vicinity of Suncor, Sarnia on September 17, 1986. ARB No.-217-86-PHYTO

(2) Ontario Ministry of the Environment. 1988. Phytotoxicology Assessment Survey Investigation in the Vicinity of Suncor Ltd., Sarnia on August 18, 1987. ARB No.-204-87-PHYTO

(3) Ontario Ministry of the Environment, 1983. Field Investigation Manual. Phytotoxicology Section - Air Resources Branch; Technical Support Sections - NE and NW Regions

(4) Ontario Ministry of the Environment, 1989. Ontario Ministry of the Environment "Upper Limit of Normal" Contaminant Guidelines for Phytotoxicology Samples. Phytotoxicology Section - Air Resources Branch ARB-138-88-Phyto. ISBN: 0-7729-5143-8

Appendix C: Derivation and Significance of MOE "Upper Limits of Normal" Contaminant Guidelines

The MOE "upper limits of normal" contaminant guidelines essentially represent the expected maximum concentration of contaminants in surface soil (non-agricultural), foliage (tree and shrub), grass, moss bags and or snow from areas of Ontario not subject to the influence of point sources of emissions. "Urban" guidelines are based upon samples collected from centers of minimum 10,000 population. "Rural" guidelines are based upon samples collected from non-built-up areas. Samples were collected by MOE personnel using standard sampling techniques (ref: Ministry of the Environment, 1983. Field Investigation Manual. Phytotoxicology Section - Air Resources Branch: Technical Support Sections - NE and NW Regions). Chemical analyses were performed by the MOE Laboratory Services Branch.

The guidelines were calculated by taking the arithmetic mean of available analytical data and adding three standard deviations of the mean. For those distributions that are "normal", 99% of all contaminant levels in samples from "background" locations (i.e. not affected by point sources nor agricultural activities) will lie below these upper limits of normal. For those distributions that are non-normal, the calculated upper limits of normal will not actually equal the 99th percentile, but nevertheless they lie within the observed upper range of MOE results for Ontario samples.

Due to the large variability in element concentrations which may be present across Ontario, even in background data, control samples should always be collected. This is particularly important for soils, which may show large regional variations in element composition due to difference in parent material. Species of vegetation which naturally accumulate high levels of an element also may be encountered.

It is stressed that these guidelines do not represent maximum desirable or allowable levels of contaminants. Rather, they serve as levels which, if exceeded, would prompt further investigation on a case by case basis to determine the significance, if any, of the above normal concentration(s). Concentrations which exceed the guidelines are not necessarily toxic to plants, animals or man. Concentrations which are below the guidelines are not known to be toxic.